Class I-SP Study Guide

08/00

Please refer to the "Reference Book List" for a complete list of recommended study materials.

Basics

(1) What is the average per capita domestic sewage flow?

(2) As sewage ages, bacterial activity first converts insoluble organic to what?

(3) What kind of algae is desirable in a pond because it is mobile and stays near the surface?

(4) Typical products of aerobic bacteria in a waste stabilization pond are?

(5) Typical products of anaerobic bacteria in a waste stabilization pond are?

(6) What is the common form of crustaceans found in a pond?

(7) Can warm water hold more oxygen than cold water?

(8) What is "oxygen demand"?

(9) What are the sources of oxygen in a waste stabilization pond?

(10) What are the two major forms of algae found in a waste stabilization pond?

(11) What is "photosynthesis"?

(12) When do algae stop producing oxygen?

(13) At what part of a waste stabilization lagoon will the microbial population be the greatest?

(14) What happens if a pond is overloaded?

(15) Name two types of anaerobic bacteria that stabilize the settled organic matter (sludge) in a waste stabilization lagoon.

(16) How do algae help aerobic bacteria?

(17) Describe the secondary treatment of wastewater in a pond.

(18) Describe aerobic ponds.

(19) Describe anaerobic ponds.

(20) What is the difference between lagoons and ponds?

(21) Discuss “parallel” and “series” operation.

(22) Describe the modes of discharge used for a pond.

(23) Explain “controlled discharge”.

(24) For controlled discharges, certain periods of the year are normally selected. Explain the reason.

(25) Describe “spring turnover” problems.

(26) Explain “short circuiting” in a pond.

(27) Describe facultative ponds.

(28) What natural factors affect the treatment process of a pond?

(29) How will biological activities be affected with a drop in temperature?

(30) What is the effect of a sudden drop in temperature for a pond?

(31) Describe the function of sunlight in the operation of a pond.

(32) Describe physical factors affecting treatment of wastewater by a pond.

(33) Explain why series operation of ponds is desirable in warmer months.

(34) Describe chemical factors affecting operation of a pond.

(35) Describe oxygen demand of wastewater.

(36) Describe the pH changes in a pond throughout the day.

(37) Discuss nutrient requirements for proper pond operation.

Operational Control of Ponds

(1) What are the three major points of measurement for proper operation of ponds?

(2) Describe control parameters of pond operation.

(3) What is one of the most important factors affecting pond operation?

(4) Discuss sample collection of wastewater in a pond operation.

(5) Discuss the types of samples.

(6) The collection of samples for a pond is recommended at a certain time of the day. Discuss this.

(7) Discuss the preservation of samples.

(8) Discuss sample collection from a pond.

(9) Discuss the solubility of oxygen in fresh water.

(10) Discuss the need of an influent flow measurement for operation of a pond.

(11) Discuss the effect of algal growth on the effluent pH of a pond.

(12) Discuss BOD.

(13) Discuss the relationship between SS and BOD. Why is SS difficult to remove from pond effluent?

(14) What are nitrification and denitrification?

(15) Discuss three steps of nitrification.

(16) Discuss the importance of pond effluent color.

(17) Discuss the importance of weather in pond operation.

(18) Discuss the significance of water depth in pond operation.

(19) Discuss ice cover reporting in a pond operation.

Operation and Maintenance for Ponds

(1) Discuss operation and maintenance goals for stabilization ponds.

(2) Describe operation and maintenance goals for anaerobic ponds.

(3) Discuss waste stabilization pond items that require daily monitoring of operation.

(4) Discuss the regulation of flow to improve pond operation.

(5) Discuss the use of baffles and screens for a pond.

(6) Discuss a controlled discharge program.

Troubleshooting

(1) Discuss the control of water weeds in a pond.

(2) Discuss the control of burrowing animals in a pond.

(3) Describe weed and vegetation control for a pond.

(4) Discuss scum control in a pond.

(5) Describe odor control for pond operation.

(6) Discuss insect control for a pond.

(7) Discuss how to correct lightly loaded ponds.

(8) Discuss a low D.O. condition in a pond.

(9) Discuss decreasing pH in a pond.

(10) Discuss the correction of short-circuiting in a pond.

(11) Describe the correction of high effluent BOD from a pond.

Safety

(1) Discuss public health aspects of pond operation.

(2) Discuss safety precautions in the operation of pumping stations and stabilization ponds.

(3) Describe safety precautions against infection while working around a pond and in a laboratory.

(4) Discuss safety concerns regarding sewer gas.

Flow Meters

(1) Describe the use of "V" notch weirs for pond flow measurements.

(2) Describe Parshall flumes.

Laboratory Analysis

(1) Discuss pH.

(2) Describe procedures of pH measurement.

(3) Describe procedures of suspended solids measurement.

(4) Discuss measurement procedures for dissolved oxygen.

(5) What is BOD?

(6) Describe BOD testing procedures.

(7) Discuss bench sheets.

Mathematics

(1) Given pertinent data, calculate the surface area of a pond in acres.

(2) Given pertinent data, calculate the volume of a pond.

(3) Given pertinent data, calculate the BOD loading to a pond in lbs/day.

(4) Given pertinent data, calculate the removal efficiency of BOD.

(5) Given pertinent data, calculate the organic loading per acre to a pond expressed in lbs/day acre.

(6) Given pertinent data, calculate the population loading to a pond expressed in person/acre.

(7) Given pertinent data, calculate the population equivalent of a BOD loading.

(8) Given pertinent data, calculate the theoretical detention time.

Formula Sheet for the Class I-SP & A-SO Exams
Revised 05/00

F001
Surface area of a pond, acres = $\frac{\text{Length, ft x width, ft}}{43560}$

F002
Volume of a pond, MG =

$$\frac{\text{(Surface area, sf + bottom area, sf)}}{2} \times \text{Depth, ft} \times 7.48 / 10^6$$

F003
BOD loading = Flow, mgd x BOD conc, mg/l x 8.34

F004
BOD removal efficiency, % =

$$\frac{\text{(Influent BOD, mg/l - effluent BOD, mg/l)}}{\text{Influent BOD, mg/l}} \times 100$$

F005
Organic loading, lbs BOD/day/acre = $\frac{\text{Flow, mgd x Influent BOD, mg/l x 8.34}}{\text{Pond surface area, acre}}$

F006
Population loading, person/acre = $\frac{\text{Population served}}{\text{Pond surface area, acre}}$

F007
Population equivalent, persons/day = $\frac{\text{BOD load, lbs/day}}{0.17}$

F008
Theoretical detention time of a pond, days = $\frac{\text{Volume of the pond, MG}}{\text{Flow rate, MGD}}$

F009
Detention time, hrs = $\frac{\text{Volume, MG}}{\text{Flow rate, MGD}}$ x 24 hrs/day

F010
Flow rate, MGD = Flow rate, gpm x $\frac{1440}{1{,}000{,}000}$

F011
Removal efficiency, % = $\frac{\text{(Influent conc - effluent conc)}}{\text{Influent conc}} \times 100\%$

F012
Solids loading, lbs/day = (Flow, MGD) x (influent TSS, mg/l) x 8.34

F013

Required effluent BOD conc, mg/l =

(Influent BOD, mg/l) x [(100 - required removal, %) / 100]

F014
Volume of a circular tank, cf = 0.785 x (diameter, ft)^2 x (depth, ft)

F015
Sludge volume index, ml/g = $\frac{\text{(Settleable solids, \%)}}{\text{MLSS mg/L}}$ x 10,000

F016
Average flow rate, MGD = $\frac{\text{(Final flow, MG) - (initial flow, MG)}}{\text{Time elapsed, days}}$

F017
BOD loading, lbs/day = (Flow rate, mgd) x (BOD, mg/l) x 8.34

F018
TSS removal efficiency, % = $\frac{\text{(Influent TSS - effluent TSS)}}{\text{Influent TSS}}$ x 100%

F019
Sludge age, days = $\frac{\text{MLSS in aeration tank, lbs}}{\text{Primary effluent SS, lbs/day}}$

F020
Volume of sample needed for a BOD test bottle, ml =

$\frac{1200}{\text{Estimated BOD of the sample, mg/l}}$

F021
BOD, mg/l =

$\frac{\text{(Initial D.O., mg/l - final D.O., mg/l) x 300 ml}}{\text{Sample volume, ml}}$

F022
Chlorine feed rate, lbs/day = (Flow, mgd) x (dosage, mg/l) x 8.34

F023
TSS test results, mg/l = $\frac{\text{Net dry weight, mg}}{\text{Sample volume, ml}}$ x 1000

F024
HTH feed rate, lbs/day = $\frac{\text{Chlorine required, lbs/day}}{\text{Lbs of chlorine in 1 lb of HTH}}$ *(HTH = High Test Hypochlorite)*